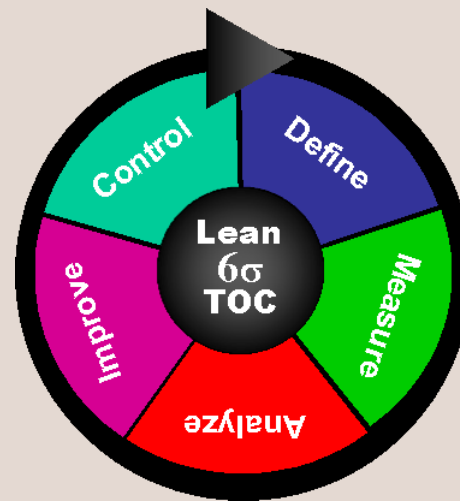


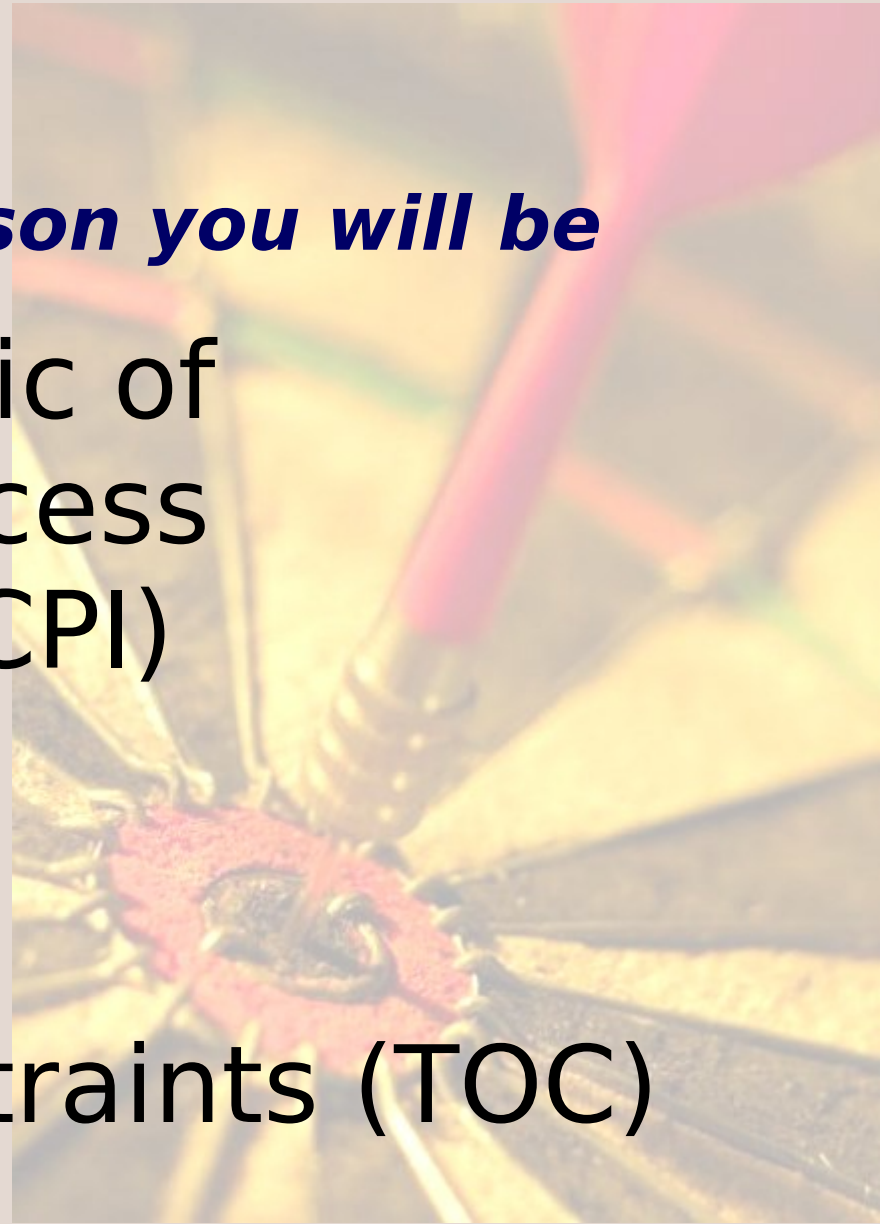
# CPI OVERVIEW



# Learning Objectives

***At the end of this lesson you will be able to:***

- Explain the basic of Continuous Process Improvement (CPI)
- Lean Thinking
- Six Sigma
- Theory of Constraints (TOC)



# History of Lean, TOC & Six Sigma

- **Roots of Lean:** back to early 1900's
- **Henry Ford:** continuous flow production, waste elimination
- **TWI:** (*Training Within Industry*), 1940-1945
- **Kiichiro Toyoda and Taiichi Ohno:** low inventories, flexibility
- **U.S. supermarkets:** pull systems
- **Shigeo Shingo:** mistake proofing, reduced set up times
- **Toyota Production System**
- **MIT and James Womack:** bring Lean back to U.S.
- **Eli Goldratt:** published book "The Goal", early 1980's (TOC)
- **Motorola & others:** developed Six Sigma early 1990's



# Three Methodologies

- **“Lean Thinking”** is a management philosophy focusing on reduction of the 8 wastes in products and services. By eliminating waste, quality is improved, production time is reduced, and cost is reduced.”
- **“Six Sigma”** can be defined as a methodology to manage process variations that cause defects, defined as unacceptable deviation from the mean or target; and to systematically work towards managing variation to eliminate those defects.”
- **“Theory of Constraints (TOC)”** is a body of knowledge on the effective management of organizations as systems.”

*Source: Wikipedia Encyclopedia*



# Eight Forms of Waste (Muda)

<b>Type</b>	<b>Physical Process</b>	<b>Transactional Example</b>
<b>Transporting</b>	<b>Parts Moving to Warehouse and Back</b>	<b>Data Handoffs</b>
<b>Inventory</b>	<b>Excessive Work-in-Process</b>	<b>Backlog of Design or Tooling Changes</b>
<b>Motion</b>	<b>Retrieving Parts, Tools, Information</b>	<b>Poor Office Lay-Out</b>
<b>Waiting</b>	<b>Parts, Tools, Information</b>	<b>Meetings, Approval, System Down Time</b>
<b>Over-Processing</b>	<b>Performing Unneeded Operations</b>	<b>Approvals (Too Many Sign-offs)</b>
<b>Over-Production</b>	<b>Working Ahead of Schedule</b>	<b>Printing Paper Too Soon</b>
<b>Defects</b>	<b>Scrap or Rework</b>	<b>Drawing or Reworking</b>
<b>Under utilization of employees</b>	<b>More people involved than required to perform physical or transactional tasks.</b>	





# Seven Wastes

2: Overproduction



7: Overprocessing



1: Defects



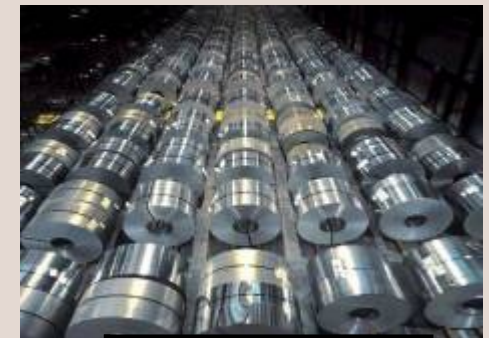
3: Motion



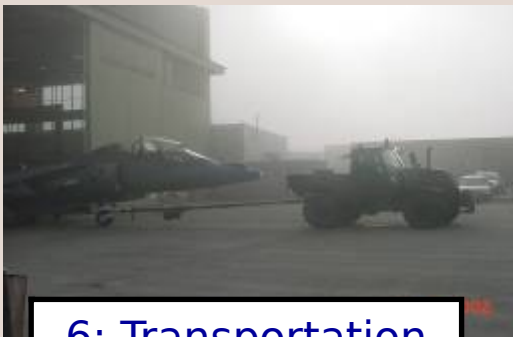
5: Wait time



4: Inventory

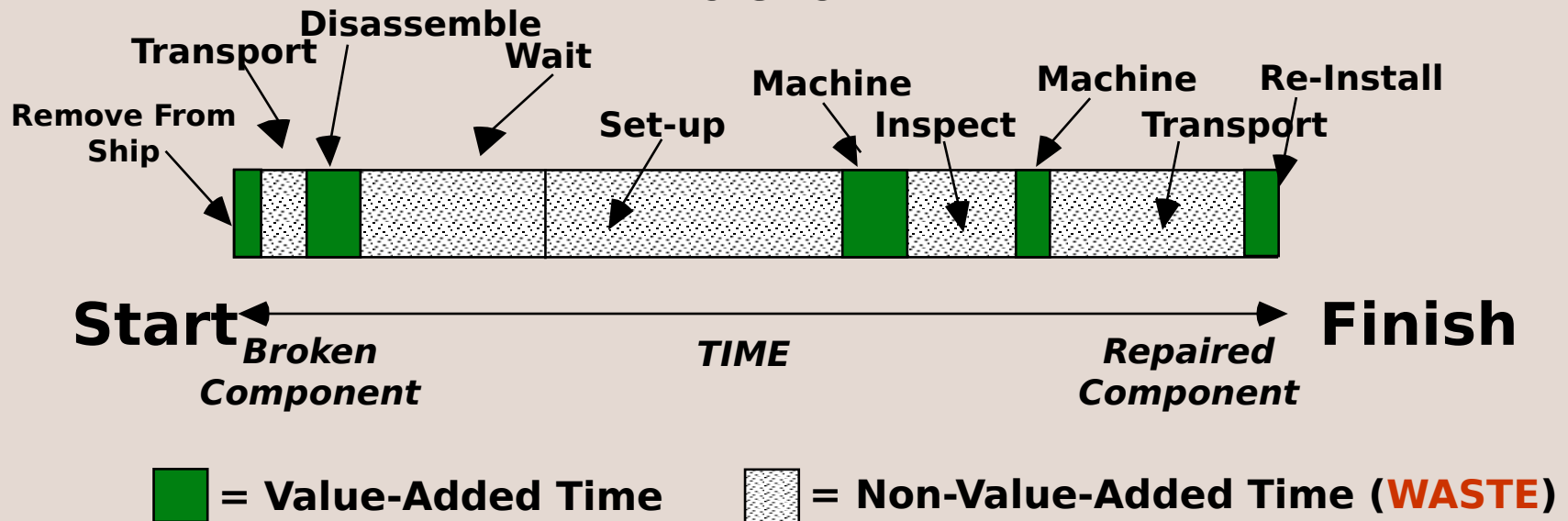


6: Transportation



# The Value of Time

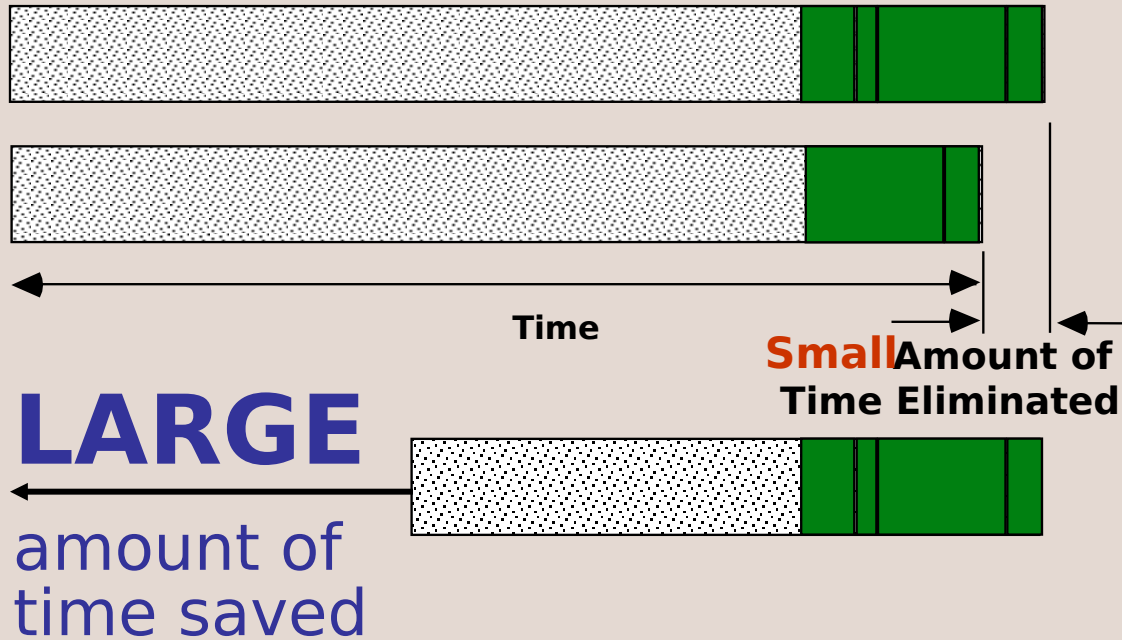
Within the 8 wastes, **time** is a significant factor.



**Value-added time** is only a very small percentage of the total time.



# The Value of Time



**Note:** The focus is not on the value-added steps or the people performing them. Instead, the focus is to remove barriers and better support the people doing the work!

## Traditional Focus

- Improve Value-Added work steps
- Better tools, machines, instructions
- Result: Small time savings

## Lean Focus

- Make all of the Value Stream visible
- Reduce or eliminate Non-Value-Added portions of the process
- Result: Large time savings



# Knowledge Check: Eight Sins of Waste



**Wastes**-Those Elements of a process that **Do Not Increase the Value** of a Product or Service ***as perceived by the Customer***, but **Increases Cost and Cycle times.**

**IDENTIFY AND ELIMINATE THESE WASTES:**

Types of Waste:

- T Transportation
- I Inventory (Excess)
- M Motion
- W Waiting
- O Over-Production
- O Over-Processing
- D Defects
- U Under utilization of employees

# What is Six Sigma ?

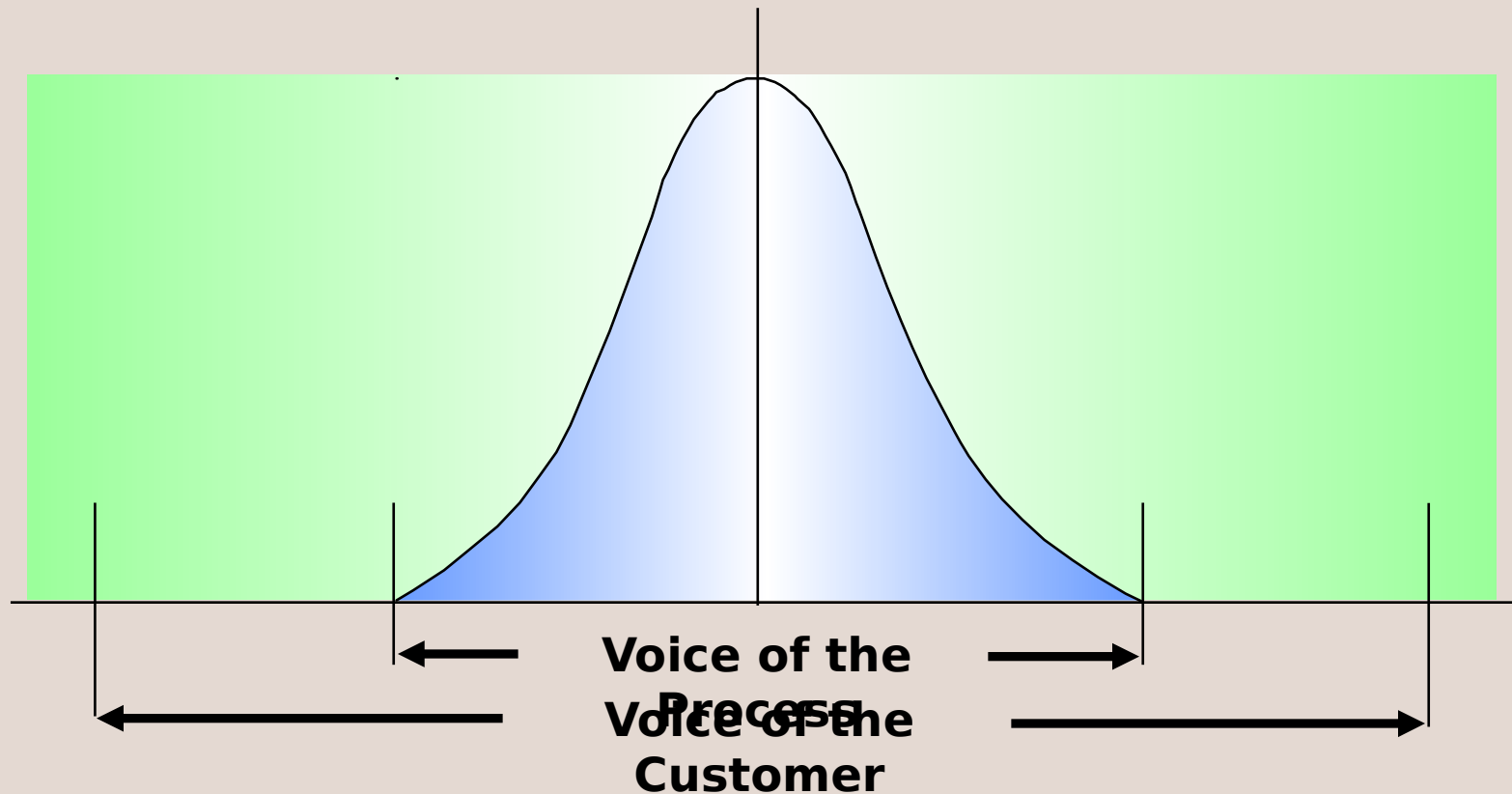
- Sigma ( $\sigma$ ) is the 18th letter of the Greek alphabet.
- In statistics,  $\sigma$  represents standard deviation, a measure of variation for process performance.
- Sigma is calculated from population or sample data.
  - Process data can be collected and evaluated to determine its impact on productivity, performance, and customer satisfaction
  - The measurements provide the ability to “predict” process performance and provide a benchmark to determine if actions have produced results

# What is Six Sigma? (cont'd)

“Six Sigma” is an optimized performance level approaching zero defects in any process - whether it produces a:

- product
- service
- transaction

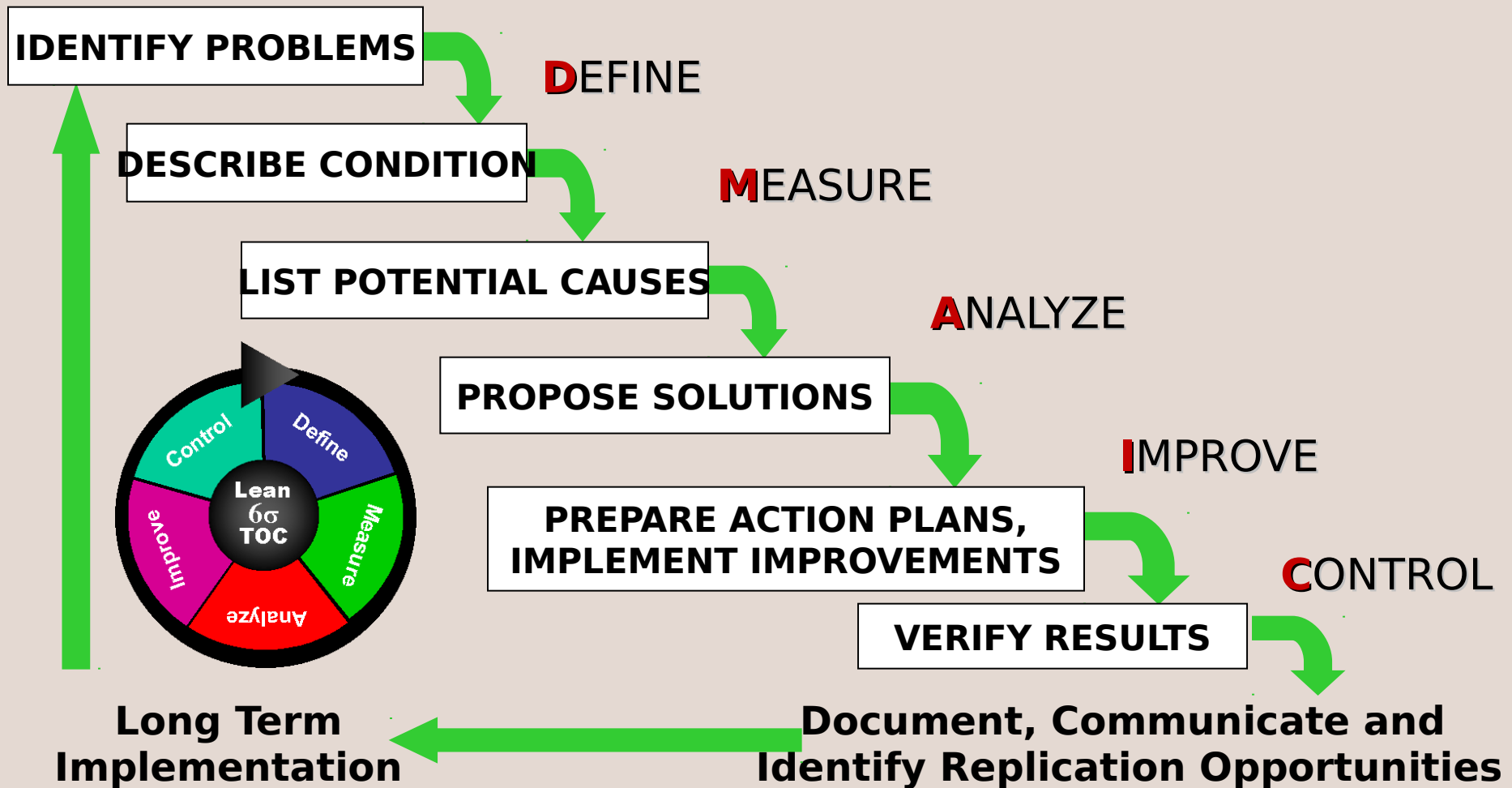
# Critical Relationship Between Process Performance and Customer Satisfaction



**MEASURED IN UNITS OF STANDARD DEVIATION  
(SIGMA)**

Source: ASQ LSS Training  
Material

# DMAIC Problem-Solving Roadmap



# Why “Six Sigma”?

**Hey, 99% is good enough right?**

**99%**

- 20,000 lost postal mail items per hour
- 15 minutes of unsafe drinking water per day
- 2 long/short landings per day at a major airport
- 5,000 incorrect surgical operations per week
- 7 hours of lost electricity per month
- 20,000 incorrect prescriptions per month



**99.99966% (6 Sigma)**

- **7 lost postal mail items per hour**
- **1 unsafe minute every seven months**
- **1 long/short landing every five years**
- **1.7 incorrect operations per week**
- **1 hour without electricity every 34 years**
- **68 wrong prescriptions per year**

# What is “Theory of Constraints” (TOC)?

- **Basic assumption:** EVERY SYSTEM HAS A CONSTRAINT
  - Knowing the location of a process’s constraint enables focused improvements to maximize overall performance
- **Provides the foundation for the design of the system to:**
  - Synchronize supply to customer demand
  - Protect its constraints from the effects of variation
- **Focuses improvement efforts** to areas where real “bottom-line” results will be achieved



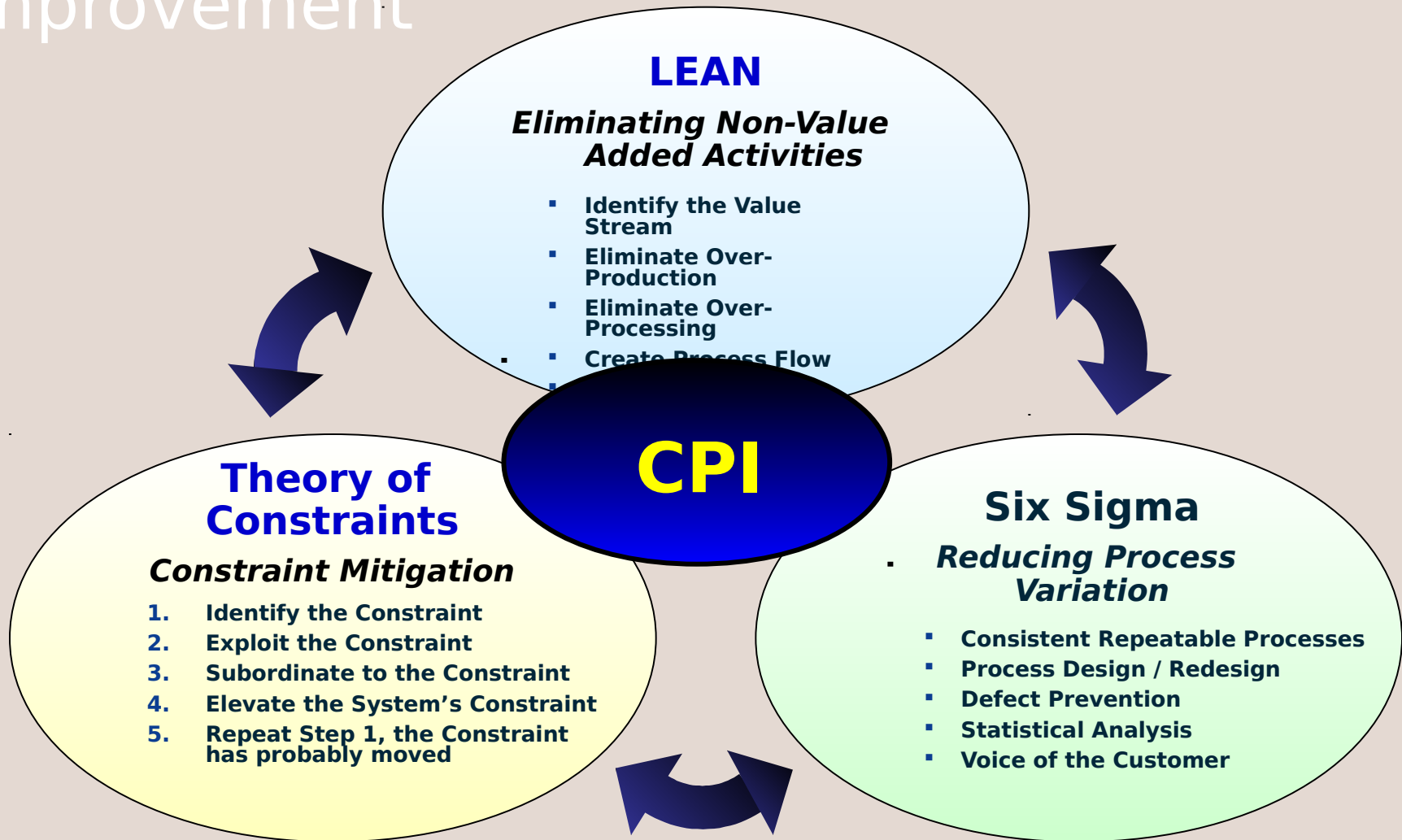
# TOC – The 5 Focusing Steps

- 1. Identify** - What's the constraint?
- 2. Exploit** - Utilize all resources to balance workloads.
- 3. Subordinate** - Focus non-constraints towards supporting the constraint
- 4. Elevate** - Increase the constraint's capacity
- 5. Repeat Step 1** - The constraint has probably moved.

(From *The Goal* by Eli Goldratt)



# Integrating a Culture of Continuous Improvement





***Lean is***

***A war on Waste***



***Six Sigma is***

***A war on variation***



***TOC is***

***Focusing on the  
constraint in the  
flow of a process***

# Intro Value Stream Map

CSSG-3 PART REQUISITIONING  
PROCESS FOR LEVEL 3 & 4  
ECHELON MAINTENANCE



# What is a Value Stream Map?

- A visual tool to help see and understand the flow of material and information.
- An illustration of all actions currently required to deliver a product.
- A big picture perspective that focuses on improving the whole, not optimizing pieces of the process.
- A pencil and paper tool that requires physically observing the process.



## *Current State VSM*

- A pictorial view showing how material and information currently flow

## *Future State VSM*

- A pictorial view showing improved material and information flow seeking to optimize the whole from the standpoint of the final customer.

# Why Map a Value Stream?

- Highlights sources of waste
- Describes how processes should operate
- Links the information flow and material flow
- Creates an improvement plan
- Ties lean concepts and techniques to improvement

# Value Stream Maps

## *Who?*

Anyone with paper and pencil

## *What?*

Time, Space, Cycle, Tools, Equipment, Manpower, Shifts...

## *Where?*

In the shop

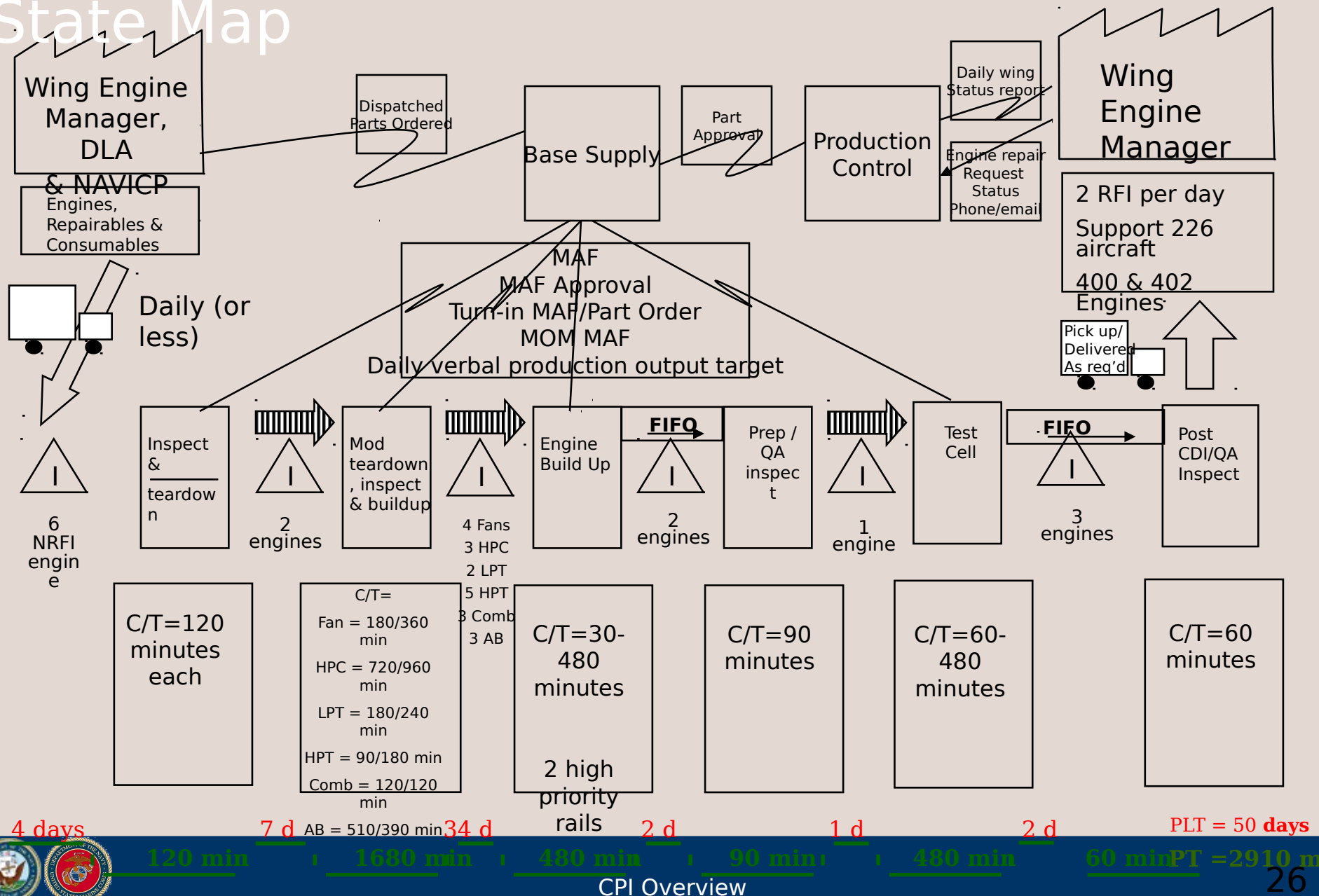
## *When?*

During shop activity

## *How?*

Utilize data collection tools (interview sheet, time obs sheet, etc.)

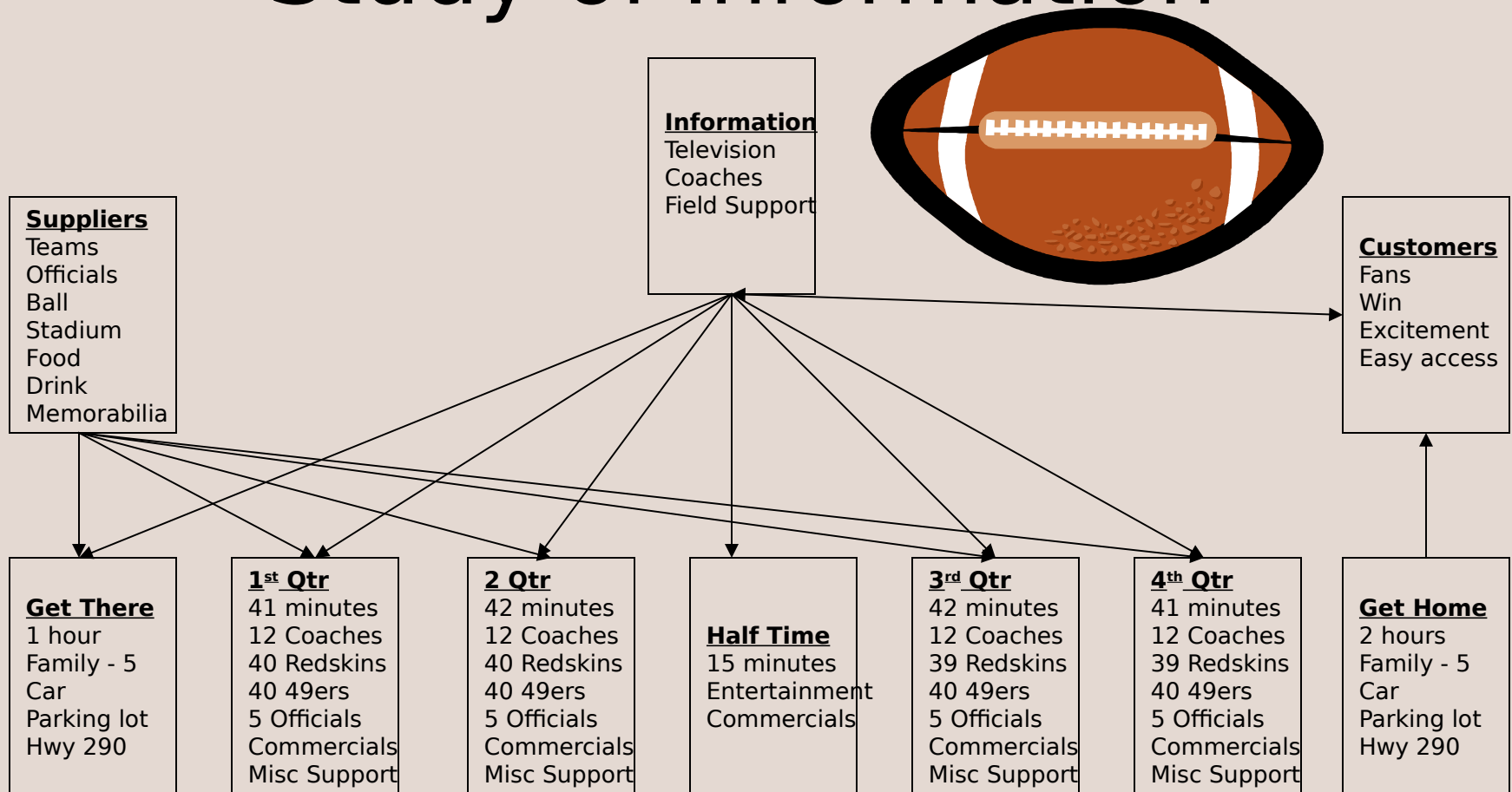
# ABC Engine Maintenance Current State Map





# The Football Game and Value Stream Maps

# Value Stream Of Football Study of Information



Observed Time 181  
Minutes Overview

# Football Value Added Time

**The only true value added time is the time from when the ball is snapped until the referee whistles the play is over.**





# Football Non-Value Added Time



Television commercials

Halftime activities

Walking back to the huddle

Arguing with the referee

Chatting with the coach

Moving the markers

Setting up the line of scrimmage

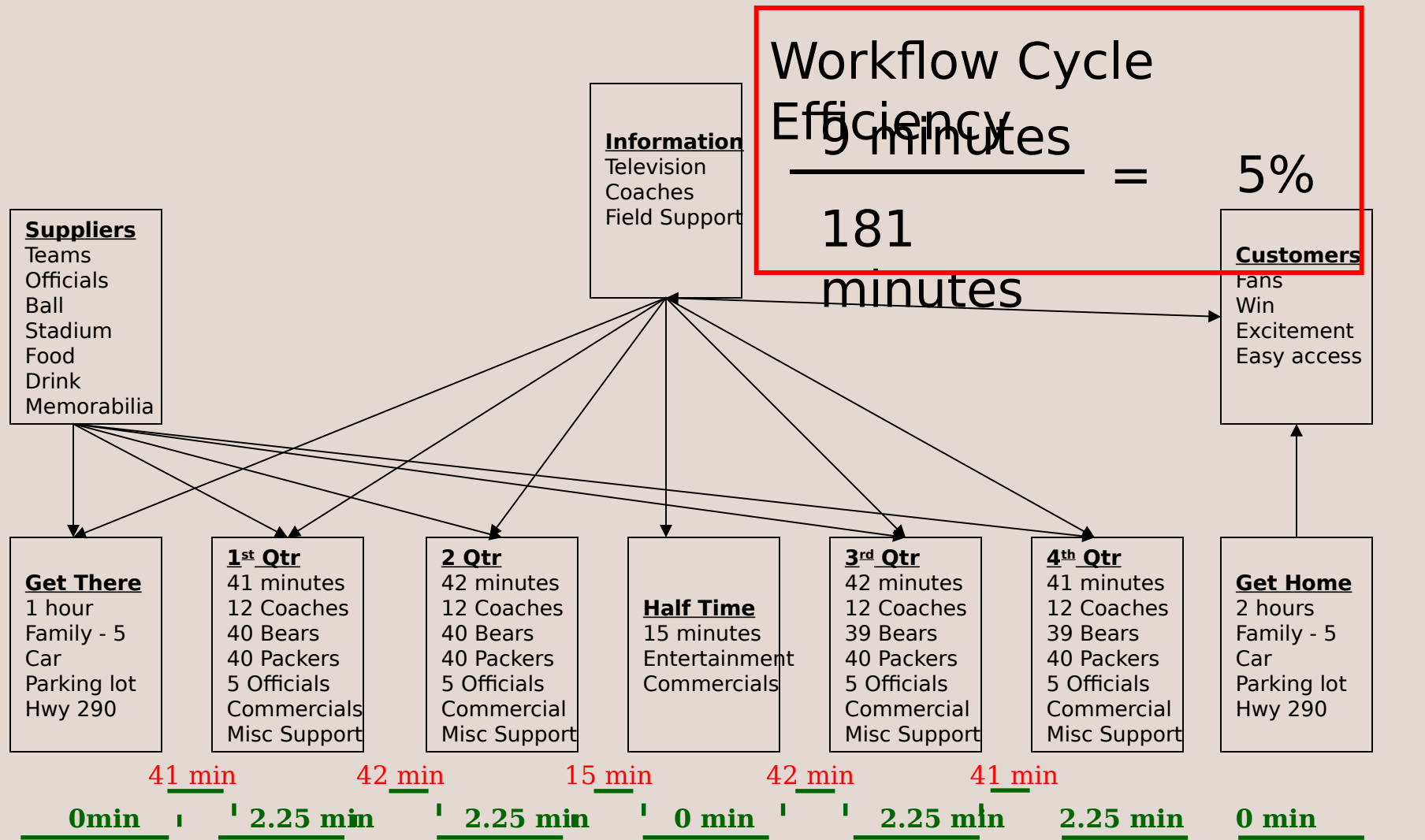
None of these actually move the ball towards the goal of scoring points

# Football Fact



From a study of NFL and college games, teams execute plays for 8 minutes and 54 seconds

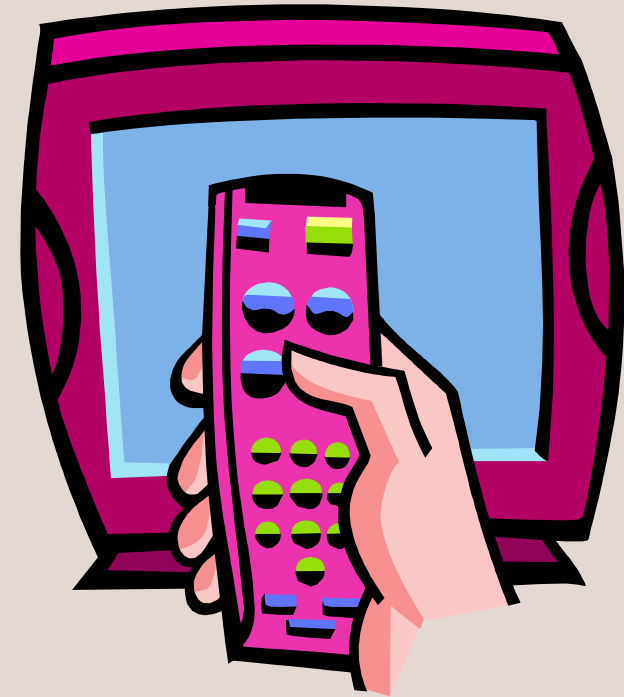
# Value Stream Of Football Study of Information



Some may argue that the entire 180 minutes of football is value-added entertainment.

**Consider this –**

If the 9 minutes of actual play was taken away would anyone sit through the other 171 minutes?



# Get Started

- Collect data using:
  - Time observation
  - Spaghetti chart
  - Data sheet



# WASTE WALK FORM

**Location:**

Sheet \_\_\_\_\_ of \_\_\_\_\_

Date:

**Total Process Time:**

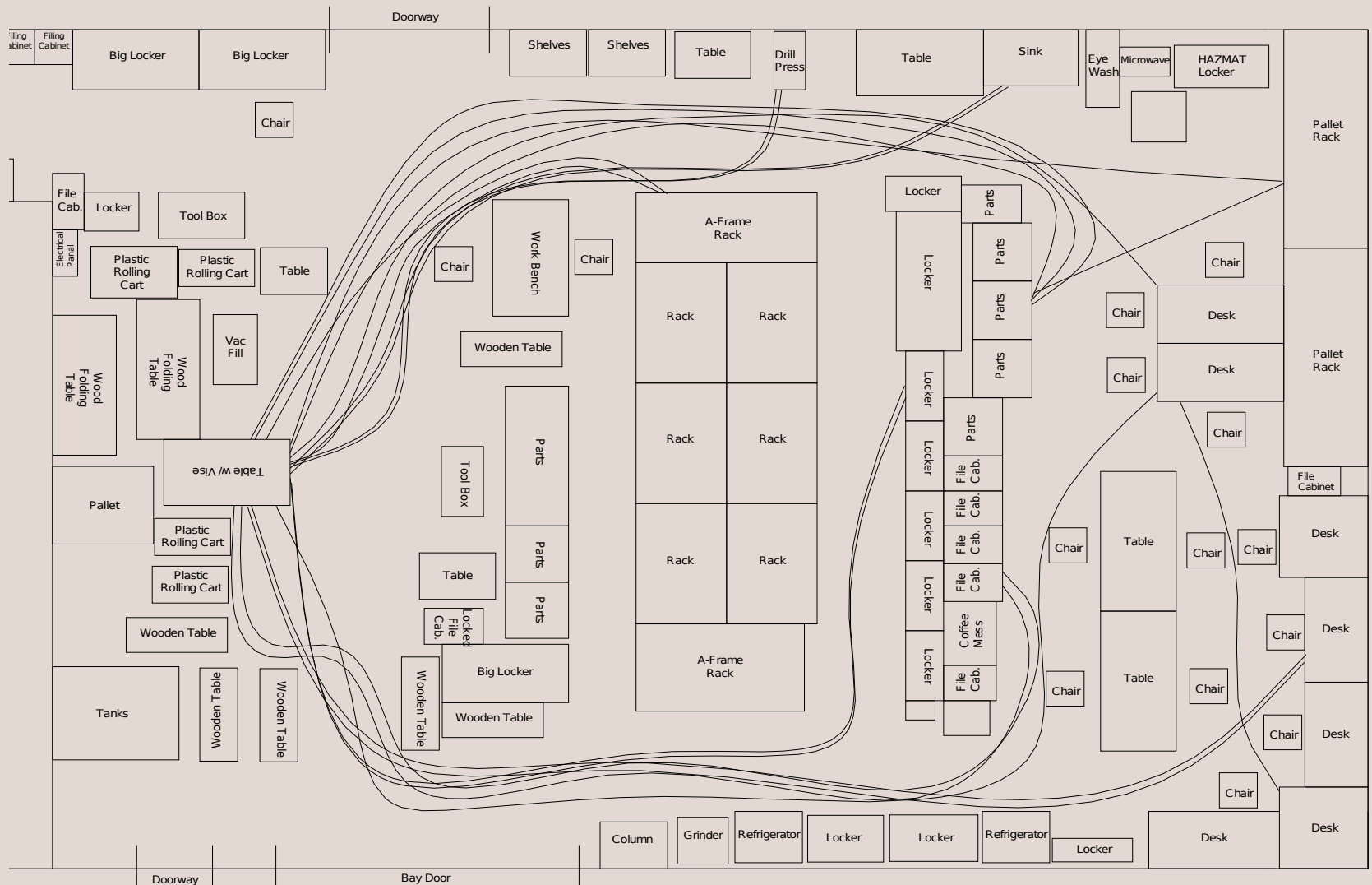
**For a Waste Walk, complete this portion only**

Type of Waste	Actual Observation with Data
Over- production	
Inventory	
Motion (body)	
Transportation (part)	
Waiting	
Over-processing	
Defects / Correction	
Safety Issues	



# Shop 56N

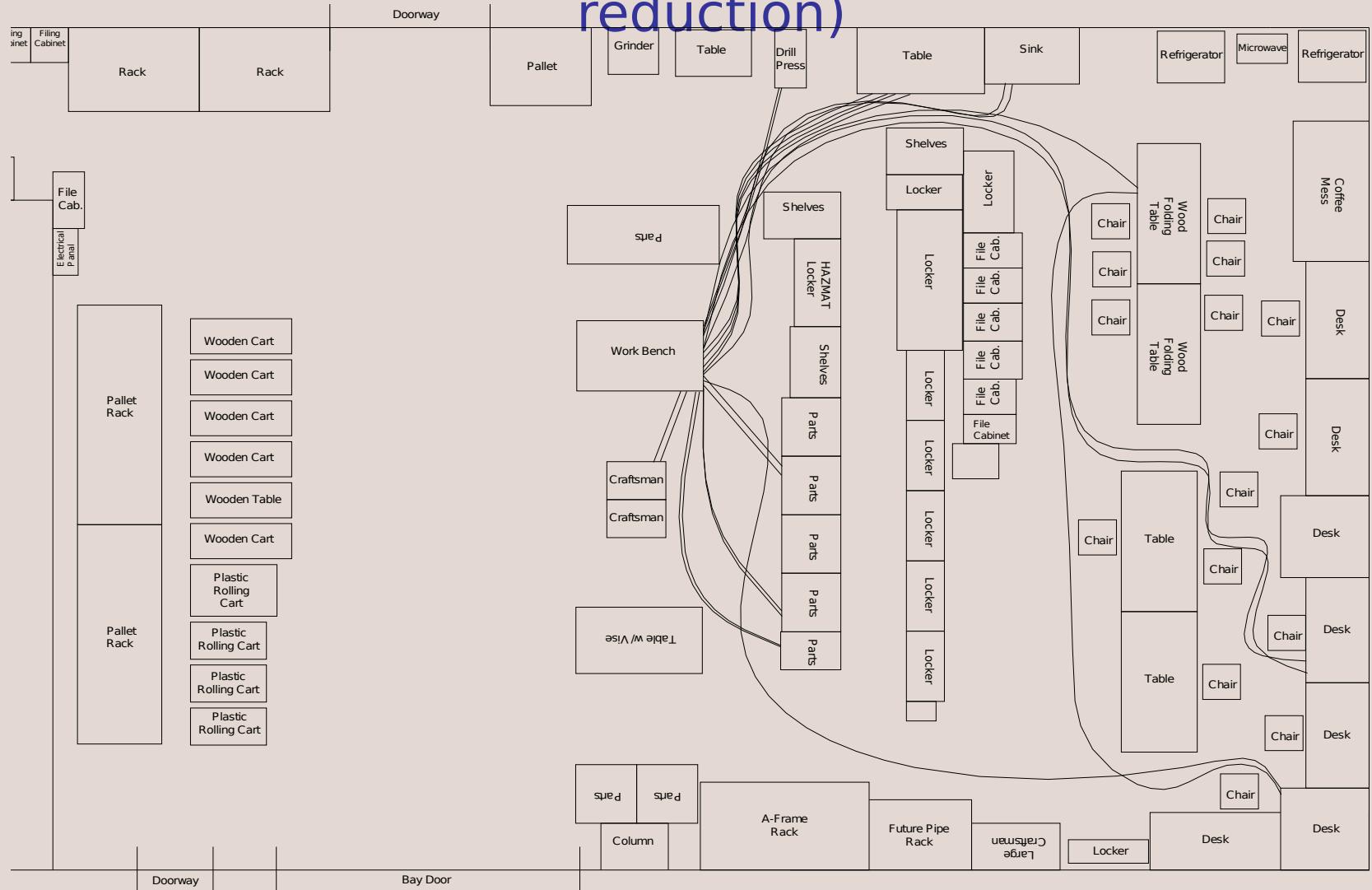
BEFORE—1063 ft per job





# Shop 56N

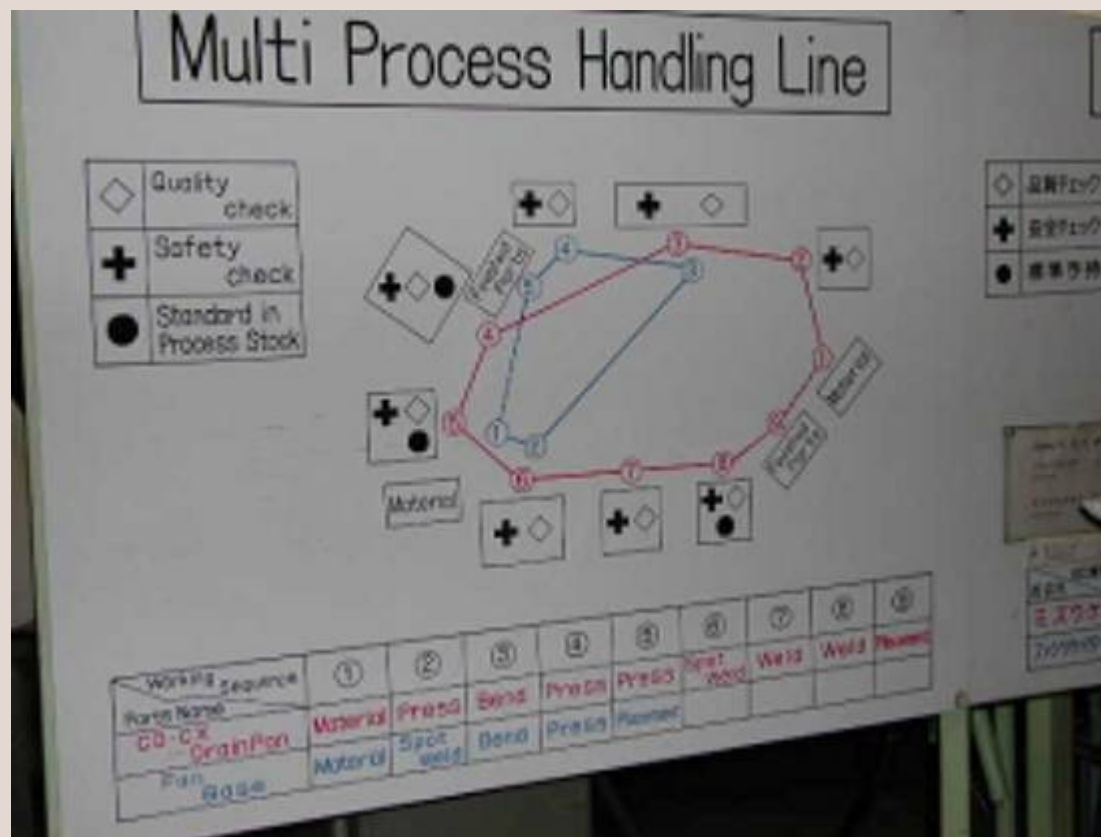
AFTER—581 ft per job (45% reduction)



# Effective Visuals

Create a work environment that is...

- Self – explaining
- Self – ordering
- Self – regulating
- Self - improving



## Other Examples



**shadowing**



**strike zones**



**foot printing**



**striping**



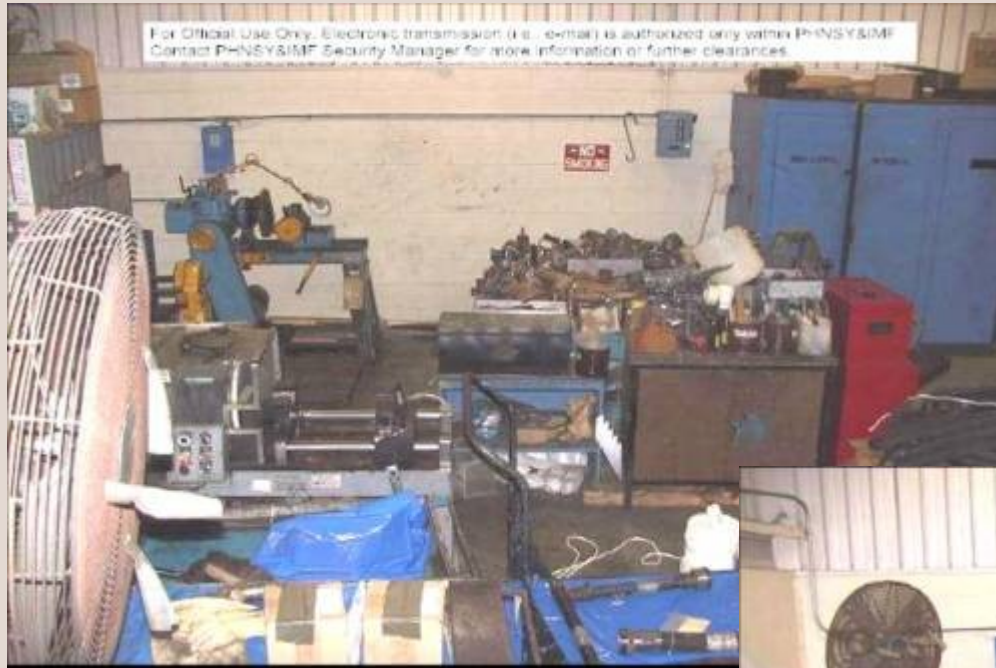
**color schemes**



**Control Boards**



# Shop 56 Flex Hose Room



"Before" Picture

Where are parts and tools stored? Little workspace available



"After" Picture

Sorted, straightened,  
scrubbed, shined, &  
standardized area

Statement D: Distribution authorized to DoD and DoD contractors only, to protect technical information as required by SECNAVINST 5518.36. Electronic transmission (i.e., e-mail) is authorized only within PMSY&DMF or to another Naval Shipyard. Transmission to NAVSEA, DoD activities or DoD contractors must be transmitted via a classified network. Other requests must be referred to PMSY&DMF Security Manager



## Pumps and Motors

- Eliminated clutter
- Eliminated 86% of travel distance per lathe operation
- Product flow aligned with crane configurations

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- Reduced overtime by \$60,000
- Increased floor space
- Increased work capacity by 20%
- Improved organization of tools and consumables





# INCREASE EFFICIENCY IN THE SUPPLY

- **Project Information** Project Sponsor: Col. Liles
- Deployment Sponsor: Major Irons, and Capt. Pirttinen
- Subject Matter Expert: 1stLt. Taibi, and GySgt. Latimer
- CPI Team Support: Kevin G. Emery, and Brian Nuss
- Duration: 9 July 07 – 7 December 2007
- Man-hours: 6 team members, 2 Green Belts and 2 Black Belts
- **Business Impact** The benefit of decreasing the Order to Ship Time (OST) will be to increase equipment readiness by the timely receipt of parts to the using units.
- **Opportunity or Problem Statement** The opportunity is to increase the supply chain efficiency aboard Marine Corps Base Hawaii (MCBH) by decreasing the Order to Ship Time (OST) to using units. This analysis will consist of requisition submissions, identification of requisition statuses and the distribution process once the requisition is released from the source of supply. These steps will cover each source of supply that is used by the using units and by intermediate maintenance for supply requisitions going through the Maintenance Company stockage point, the Sassy Management Unit, the Repairable Issue Point, Defense Depot Pearl Harbor (DDPH), Tracy Defense Depot and other major supply sources. The result will be an increase in mission readiness through enhanced supply procedures for support units. The overall OST has been an average of less than one day for the Maintenance Company stockage point, two days for the SMU, two to three days for DDPH, and greater than two weeks depending on how fast requisitions are received and filled at Tracey for shipment to MCBH.
- **Goal Statement** The benefits are increased equipment readiness, streamlined ordering process, and better usage of operational funds. These benefits will come from the elimination of wasted man-hours that stem from tracking lost shipments and the re-working of failed requisitions. This process will be improved by applying statistical analysis to identify key constraints in the OST for requisitions and the history of overall failed requisitions in order to identify the root causes of the delay in receipting for supply parts. Once all data is collected, it will be used to set quality control measures to the requisition process. End state: 100% of all requisitions will receive good status and processed for delivery within the stand time line from their respective source of supply the first time the request is submitted and an overall reduction in the receipt time for materials ordered.
- **Project Scope**
- The processes involved are the maintenance and supply requisitioning process, reconciliation process, shipping process, distribution process and receipting process.
- Col. Liles, CSSG-3 Commanding Officer  
Project Sponsor & Unit

